A NEW PRECISION SYRINGE FOR THE ACCURATE INJECTION OF SMALL QUANTITIES; A HOLDER FOR SUCH SYRINGES AND FOR OTHER PURPOSES.*

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The syringe here shown consists of a piece of 1 c.c. pipette, one end of which is ground to fit a Luer needle; to the other end is attached an ordinary atomizer bulb from which the outlet valve has been removed.

To fill the syringe, the air is forced out of the bulb as shown in Fig. 2, the inlet valve is closed with thumb or finger (Fig. 3), and the needle is held in the fluid to be taken up. If the hub of the needle is kept above the level of the fluid, any imperfection will be shown by the entrance of air bubbles. If the connection is perfect the fluid rises slowly and steadily. The rising column may be stopped instantly at any point by removing the thumb from the inlet valve and allowing the bulb to fill with air from that direction.

FIG. 1.

When filled, the syringe may be held horizontally without danger of the contents escaping. If the end of the needle is dipped in vaseline the instrument may be placed in any position, even upside down, without change in the level of the fluid. Fig. 4 shows a number of syringes filled and ready for use, one of them upside down.

When an injection is to be made and the needle has been introduced, a slight quick pressure on the valve closes the inlet valve and the fluid is forced out, slowly or rapidly, by steady pressure on the bulb. The amount injected is read off on the scale, and may be determined with great accuracy. The column of fluid in the syringe may be started and stopped any number of times in the course of an injection and is so readily controlled that,

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with a little practice, it is very easy to start and stop it two or three times within the 1/100 division marks on an ordinary 1 c.c. pipette.

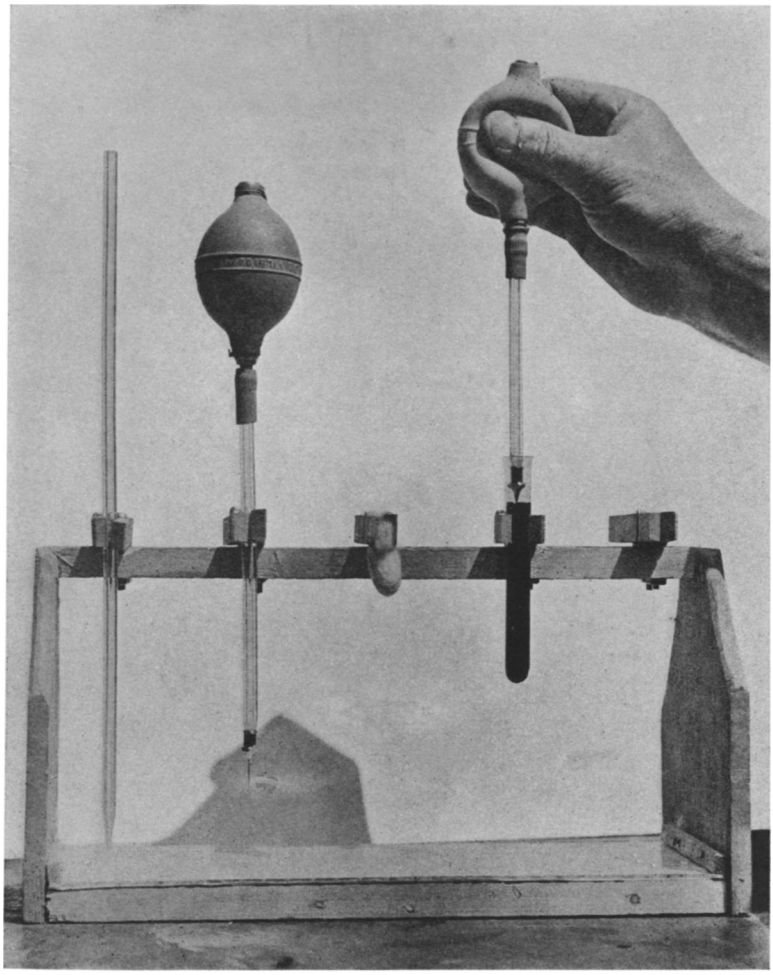

FIG. 2.

The instrument was devised to meet the requirements of an examination into Römer's method of standardizing diphtheria antitoxin in which accurate measurement of the quantities injected

is exceptionally important on account of the high dilutions, the small quantities involved, and the necessity of avoiding unequal pressure effects in the injected areas. A paper on this subject is

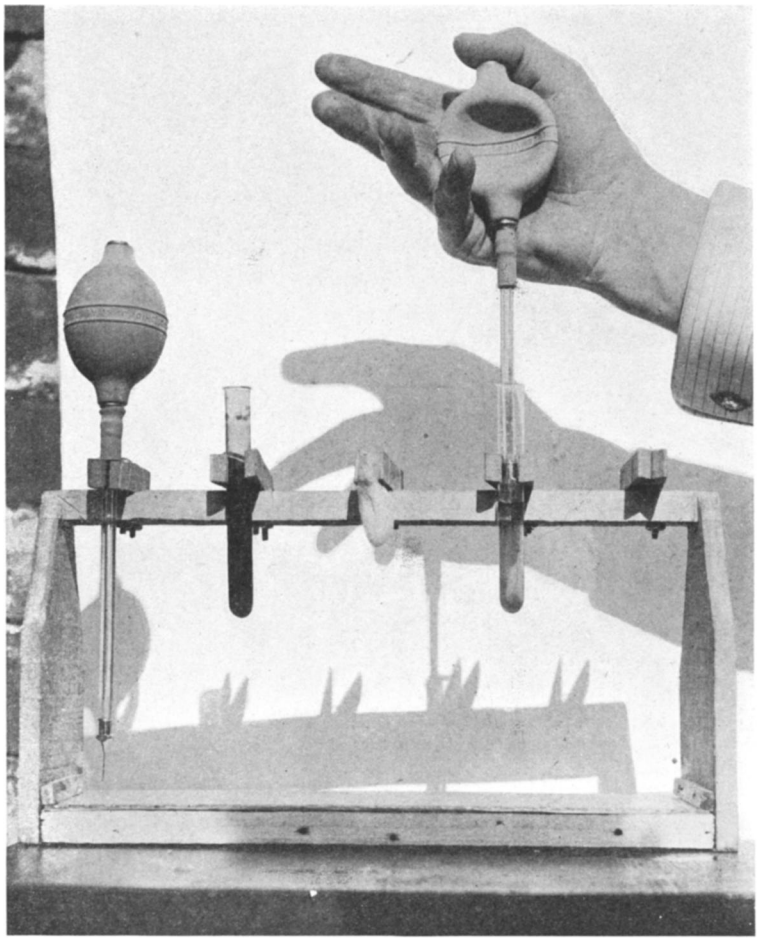

FIG. 3.

in preparation, but a brief description of the method and some of the results obtained will be given here to show the suitability of the instrument for purposes requiring exact measurements.

In Römer's method, toxin and antitoxin dilutions are made in

such a manner that the desired quantity of each is contained in 0.05 c.c. of the dilution. Equal parts of the two are mixed and, after a time allowed for combination, are injected *into*, not under, the skin of a guinea-pig. In this way a determination is made of the amount of a given toxin which, in combination with a fixed quantity of a standard antitoxin, produces a minimum degree of necrosis in the area injected. This is called the *Limes Necrosis* dose, and sera to be tested are then titrated against this amount of toxin.

In Table 1 the standard antitoxin was so diluted that the quantity used (0.05 c.c.) contained 1/50 of an antitoxin unit. Several tests, as shown, are made on each animal.

TABLE 1.

1/50 Antitoxin Unit, Plus Toxin as Below. c.c.	Guinea-Pig No. 13	Guinea-Pig No. 15	Guinea-Pig No. 17
0.005	No necrosis	.....	.....
0.0055	.....	No necrosis	.....
0.006	.....	No necrosis	.....
0.0066	.....	No necrosis	.....
0.00683	.....	.....	No necrosis.
0.007	.....	.....	Necrosis? Too slight to be sure of.
0.00725	.....	.....	Necrosis, pinhead size, the Limes necrosis.
0.0075	Necrosis, .25 inch in diameter	.....	.....
0.01	Necrosis, more than above	.....	.....
0.0125	Necrosis, proportionally more than above	.....	.....

When toxin alone is titrated to determine the minimum intracutaneous necrotic dose, still smaller fractions are involved. The importance of accuracy in the measurement of the quantities injected may be judged from Table 2.

TABLE 2.

Amount Injected	Guinea-Pig No. 2		
	After 48 Hrs.	After 4 Days.	After 6 Days.
0.1 c.c. containing 0.0001 c.c. toxin (left front)	Slight necrosis	Necrotic area, $\frac{1}{4}$ in. in diameter	No change
0.1 c.c., 0.000075 c.c. toxin (left back)	Infiltration	Necrosis about equal to above	No change
0.00005 c.c. toxin (right front) —0.1 c.c.	Infiltration	Distinct necrosis less than $\frac{1}{8}$ inch	No change—the min. necrotic dose
0.1 c.c., 0.000025 c.c. toxin (right back)	Infiltration	Tissuepaper-thin scaling of skin	No change

Römer used, as did Lewin who reviewed Römer's work, a 1 c.c. Pravatz syringe graduated in 20ths. Similar syringes in this laboratory did not seem adequate to the technic; nor could anything better be found in San Francisco. The one here described has

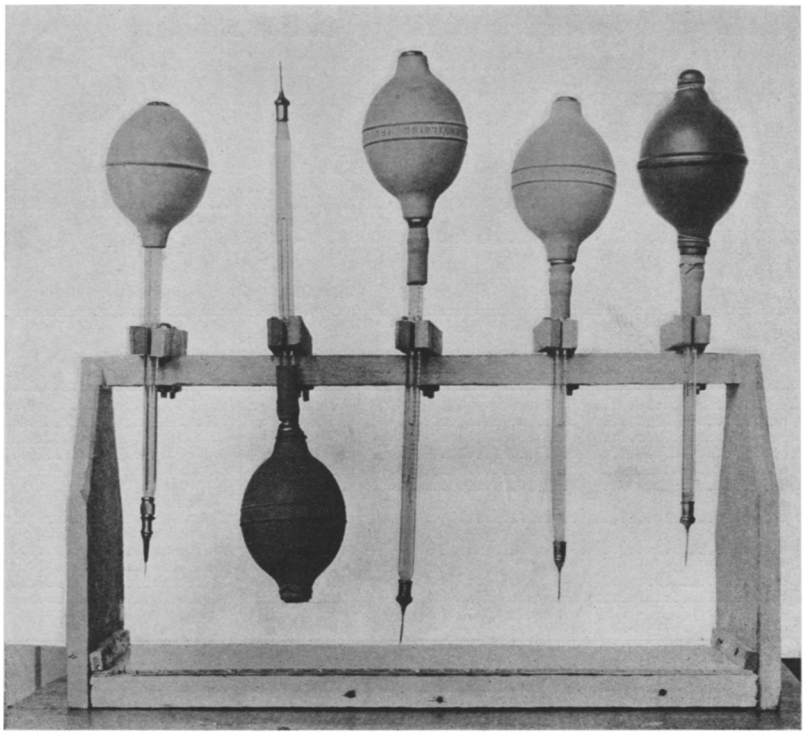

FIG. 4.

proved equal to the requirements. Its accuracy is that of the pipette itself.

The holder needs no explanation beyond the illustration. It consists simply of a number of clothespins fastened on a stand. Other purposes it may serve besides holding the syringes are also indicated in the illustrations.